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DROUGHT AS A PRIMARY CAUSE OF TOP KILLING

SIERRA NATIONAL FOREST.

The abnormally dry season of 1924 was followed by a decided increase in the number of dying trees, not only on the Sierra Forest, but from reports, on the Klamath, Stanislaus and parts of the Lassen as well. It was believed that this condition was at least partially the result of the drought. The precipitation for the winter and spring of 1924 was the lowest for any similar period of which there is any record.

On the Sierra an unusually large number of the fading trees were found to be only top killed. On the Cascadel Unit, an area of about 5 sections, 69 out of 152 trees marked in cruising, or 45%, were top killed trees.

METHOD:

Fifteen of these top killed trees were felled and studied to determine the cause of the top killing and the effect of the drought on the vigor of the trees. The trees studied were all on the Cascadel unit but similar conditions are to be found on other parts of the Sierra Forest.

The presence and location on the tree of any insects found were noted as well as the amount of brood and its stage of development. Wood sections were also taken from each tree, one at the base, one at or near the top, and where insects were present, one at the lowest point at which insects were found on the trunk. A number of cores from D. brevicomis killed trees and green trees on the same area were available as checks in this study.

INSECTS FOUND:

The most common insect in these top killed trees is Ips confusus. Buprestids were also fairly common and D. brevicomis was often found lower down on the tree. In most cases only the top 10 or 15 feet was killed but in a few trees, especially those containing D. brevicomis, the trees were attacked down to within 20 or 30 feet of the base. The amount of faded foliage varied from 5 feet of the top to nearly the entire crown. In many of the trees, Ips and buprestids were found in the tops in a more advanced stage of development than the D. brevicomis broods lower down, showing that the Ips probably favored by the weakened condition of the tree, really initiated the attack. Most of these trees would recover, except for a stag top, but for these D. brevicomis attacks.

CHARACTER OF 1924 ANNUAL RING:

It was noticeable that the 1924 rings were narrower than the average for the last five years. Measurements from 58 cores give a ring width for 1924 of .02" against .033" for the last five year average. The most important characteristic of the 1924 ring, however, was its small amount of late wood. During the spring the rainfall was sufficient together with good growing conditions (especially temperature) to cause a good growth and the width of the early wood for 1924 is nearly equal to that for 1922. Then instead of putting on late or summer wood the trees either completely stopped growing or put on only a very small amount of late wood.

This lack of late wood is especially noticeable on the top killed trees where only 2 out of the 15 examined showed any late wood and these 2 only a trace. 21 out of the 30 green check trees examined had some late wood, tho

most of them had only a small amount. This gives only 13% of the top killed trees with late wood while 70% of the green check trees formed late wood. As the late wood had not changed much in color its presence was determined by the thickness of the cell walls. A binocular microscope being used for this purpose. There was some chance for error in this method but the results on the two sets of trees should be comparative.

A number of yellow pine seedlings 12" to 54" in height which died in the fall of 1924, evidently from lack of moisture, had the same type of ring with a fair amount of early wood but no late wood.

CONCLUSION:

This sudden stopping of growth together with the fact that in three of the trees examined no insects or other cause of death was found leads to the belief that lack of moisture is the principal cause, not only for the unusually large number of top killed trees, but also for the unusual increase in the insect infestation as a whole.

SUMMARY:

The dryest season of which there is any record was followed by an abnormal increase in the number of fading trees, especially in yellow pine.

A large per cent of the fading trees proved to be only top killed, 69 out of 152 or 45% on the Cascadel Unit.

The drought is believed to be a primary cause of this top killing for the following reasons:

1. Three of the 15 top killed trees examined had no insects or fungi present or showed any sign of injury that would account for the top killing.

2. A study of the annual rings showed an almost complete lack of late wood, indicating that the growth of the trees practically stopped after the formation of the early wood in the spring. This was especially noticeable in the top killed trees as only 13% of them formed late wood as against 70% for the green check trees from the same area.

3. The prevalence of Ips confusus and buprestids, normally secondary insects, in these tops, indicates low vitality in the trees.

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